

THE LIFE HISTORY OF AN EQUATORIAL MONTANE  
BUTTERFLY, *TATOCHILA XANTHODICE*  
(LEPIDOPTERA: PIERIDAE)

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*Abstract.*—Shapiro, Arthur M., Department of Zoology, University of California, Davis, California 95616.—The egg, larva, and pupa of *Tatochila xanthodice* from moderate elevations in the Cordillera Central of the Colombian Andes are described. There are numerous suggestions of affinity to the Holarctic *Pieris callidice* group. The pupa is unusual in the reduction of the frontal prominence and concomitant enlargement of the supraocular ones, and in the reduction of the dorsolateral prominences.

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The white butterflies of the tribe Pierini have undergone an adaptive radiation in the Andean region unparalleled elsewhere in the world: there are seven endemic genera and about 40 species from northeastern Colombia to Tierra del Fuego. The origins and affinities of this fauna are difficult to interpret. The butterflies occur in alpine, montane, subantarctic, temperate and Mediterranean climates, but avoid the lowland tropics. This distribution closely follows that of the Cruciferae, with which Pierines are usually associated. Traditionally the Andean taxa have been considered descendants of a Nearctic invader which penetrated South America about the time of the Andean orogeny (Klots, 1933; Forster, 1958; Mani, 1968; Field and Herrera, 1977). Evidence from recent studies of the biology of Colombian Pierines is contradictory and confusing (Shapiro, 1977a, b). There are biogeographic and physiological hints of at least older, and perhaps multiple, invasions.

The early stages of the Andean Pierines are unpublished. Several common Chilean and Peruvian species have been reared (J. Herrera, M. Etcheverry, G. Lamas M., personal communications). Any data bearing on the early stages may be useful in phylogenetic and biographic inference about these animals; as a minimum they permit comparisons with the Nearctic Pierini, which have nearly all been described thoroughly.

*Tatochila xanthodice* is a common Pierine of montane, subalpine, and (occasionally) alpine northern South America, from northeastern Colombia (Sierra Nevada de Santa Marta, 10°54'N, 3,650-4,000 m) (Ackery, 1975) south to Cajamarca, Peru (7°10'S, 2,700 m) (Herrera and Field, 1959). In south-central Colombia it is multiple-brooded with 3 or 4 generations a year at Tenerife, Department of Valle del Cauca (3°30'N, 2,700-3,000 m).

There it is a colonizing insect, breeding on European Cruciferous weeds (*Raphanus sativus* L., *Brassica campestris* L., *Lepidium ruderales* L.) in onion fields and on cultivated cabbage (*Brassica oleracea* L.) in gardens. Tenerife stock was collected in 1977 for photoperiod experiments (Shapiro, 1977a), affording the opportunity for a description of the early stages. Additional material was subsequently collected for me by Rodrigo Torres N. of Buga, Valle. Several rearing regimes were used; these are described in Shapiro, 1977a. No phenotypic variation in the adult was induced by these treatments. The descriptions which follow, including developmental rates, are for animals reared at 25°C on continuous light on fresh cuttings of *Lepidium strictum* (Wats.) Rattan.

Alcoholic material of the early stages is being deposited at the United States National Museum, Washington, D.C.

### Descriptions

*Egg* (Fig. 1).—Similar to the egg of *Pieris protodice* Bdv. & LeC. but larger, 1.2 × 0.33 mm. Erect, spindle-shaped, the chorion sculptured as figured, with 9–11 vertical ribs connected by about 40 horizontal ones. Laid singly afield on leaves and stems, less often on inflorescences; usually on the upper surfaces of leaves but frequently below; commonly found on young rosettes of wild radish with only 2–5 leaves, less often on large plants. Light orange when laid, darkening to deep orange after 12–18 h, translucent blackish 12 h before hatching. Time to hatch, 4 days.

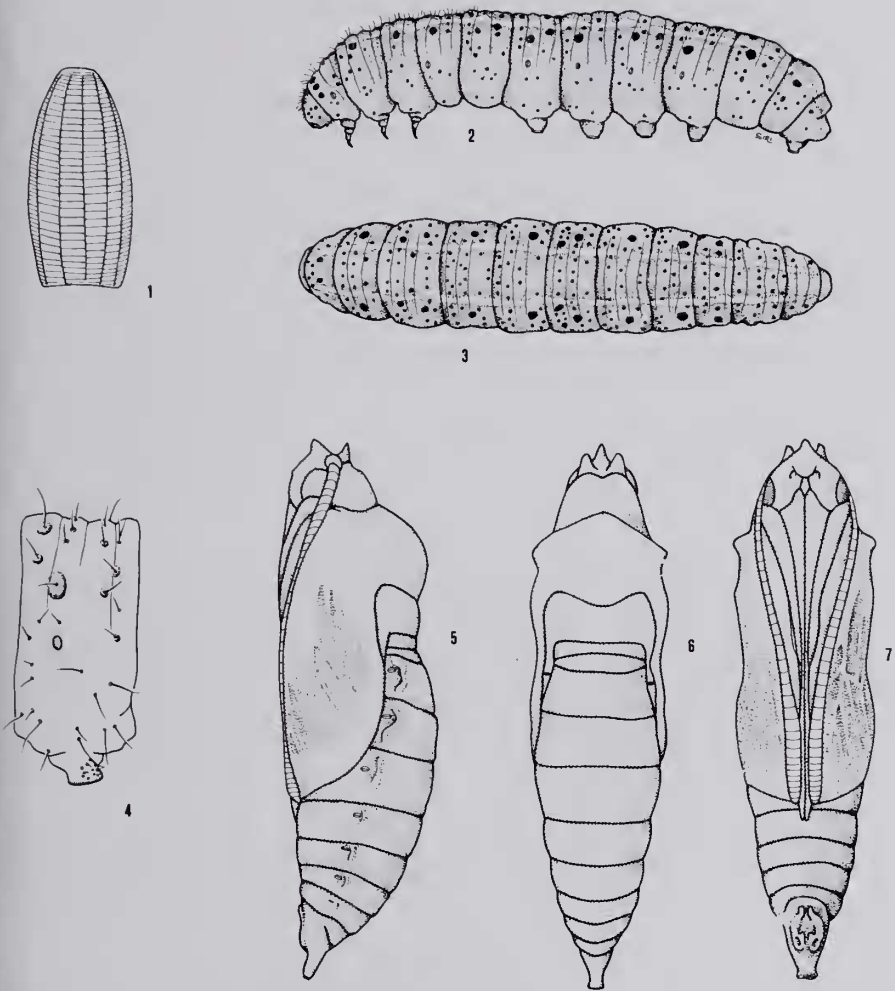
*Larva: first instar*.—At hatch 1.5 mm long at rest. Dull orange, apparently unmarked except for minute dark tubercles bearing short setae; head black. Begins as a pit feeder on leaves. Length of instar, 2 days.

*Second instar*.—After molt 5 mm long. Olive green, with two subdorsal stripes, stigmatal stripes, and a very faint mid-dorsal one all yellow. Head gray-green, ocelli black. Head and body covered with many black tubercles of 3 sizes. Length of instar 2–3 days.

*Third instar*.—After molt 9 mm long at rest. Velvety black, pattern as before, the dorsal stripe very faint to obsolete. Head plain dull black. At this stage the larva will feed indiscriminately on any aerial part of the plant, growing very rapidly. Length of instar 3 days.

*Fourth instar*.—After molt 13 mm at rest. Pattern as before, the stigmatal stripes poorly defined and dull orange, the dorsal stripe often disappearing altogether. Length of instar 3–4 days. (Very rarely the black color is replaced by a dull gray-green throughout.)

*Fifth instar*.—After molt 18 mm long, reaching 28 mm before ceasing feeding. Body with many black tubercles in 3 sizes (Figs. 2–4), each bearing a short hair. By the Kornerup and Wanscher (1967) method the two subdorsal stripes are 2A5 ("light yellow"); just before the intersegmental



Figs. 1-7. *Tatochila xanthodice* from southern Colombia. 1, egg,  $\times 20$ . 2, mature larva, lateral view. 3, mature larva, dorsal view. 4, lateral view of seventh segment, showing major tubercles. 5, pupa, lateral view. 6, pupa, dorsal view. 7, pupa, ventral view. All  $\times 25$  except 4,  $\times 65$ .

membrane at the anterior end of each segment the yellow stripes contain squarish orange (7A8, "reddish orange") spots. Stigmatal stripes weak, orange, often obsolescent. The dorsal stripe is almost always absent. (Very rarely the black color is replaced by dull gray-green throughout.) Mature larvae eat a tremendous amount, and one can strip a small *Brassica campestris* plant of its foliage and siliques. As in the *Pieris callidice* Hbn.

group, the last one or two fecal pellets produced before pupation are red. Length of instar, 5 days.

*Prepupa*.—Similar to the *P. callidice* group; attached by the anal legs and a girdle around the thorax. Usually vertical, head up. Prior to spinning a silken mat the larva wanders for 5–8 hours. Length of prepupal period, 12–30 hours.

*Pupa* (Figs. 5–7).—Length 22 mm; width at girdle 5 mm. Initially colored like the larva/prepupa, assuming its final coloration in 4–6 h. Ground color 24A2 (“turquoise white”) with numerous black dots corresponding to the larger larval tubercles, and two rows of orange spots dorsally corresponding to those in the larval subdorsal lines, which may be faintly indicated. The pattern of the anterior portion, including the wing cases, is extremely variable. Some have this entire area unmarked 5A3 (“pale orange”). Others have it concolorous with the body, with or without heavy black filling on the wings. A few have the head, prothorax, and appendages including wings mostly black. The commonest form, with dark filling between the wing veins, is illustrated. The overall color scheme is reminiscent of pupae of *Chlosyne* and *Euphydryas* (Nymphalidae). The variation is completely uncorrelated with temperature of photoperiod. After eclosion the pupal case is pale dull brown, with all the markings preserved.

Frontal prominence greatly reduced, the two supraocular prominences of equal size; flaring prominences at the outer angles of the wing cases reduced, only very faintly indicated above the spiracles. Before eclosion the eyes, wings, and body are pigmented in that order. White is laid down 15–20 hours before black pigment in the wings. In females the outer half of the wing appears solid black in the pharate adult, and the ground color changes from white to yellow. Meconium red, as in the *P. callidice* group. Length of instar 7–10 days. The pupa is exceptionally active and wriggles if disturbed.

### Discussion

The larva of *Tatochila xanthodice* is reminiscent in facies of the *Pieris callidice* group. It differs in the reduction of the stigmatal stripes and in having fewer large tubercles. In habits it resembles *P. rapae* L., eating high-water-content Crucifers, consuming great amounts of foliage, producing very copious frass. The pupa is unlike anything found in the Nearctic, and has only a very vague and unconvincing resemblance to the similar-sized *Pieris brassicae* L. of the Palaearctic. The configuration of the various prominences is strikingly similar to the pupa of *Reliquia santamarta* Ackery (Shapiro, 1977b) although that species is more of a “normal” Pierine and looks much less odd. The larva and adult are extremely constant, contrasting with the variable markings of the pupa. Three of about 70 larvae reared were gray-green rather than black; they produced unexceptional pupae and adults.

The coloration of the larva and pupa of *T. xanthodice* recall the Nymphalid genus *Euphydryas* of north temperate latitudes. In that genus the behavior of the larva and adult suggests distastefulness, and the coloration may be aposematic. No information is available as to the palatability of *Tatochila*, but the larvae are fully exposed and conspicuous on their host plants. The adult female of *T. xanthodice* is the most heavily melanized Andean Pierine; its behavior suggests a thermoregulatory function for the pigmentation. The same may be true for the larva.

In general the morphology of the early stages of *T. xanthodice* supports the inferred derivation of the group from a Nearctic invader akin to the present *P. callidice* group. The recently studied *R. santamarta* from north-eastern Colombia is a feasible intermediate. The tendency toward reduction of the frontal prominence occurs also in the very unusual Nearctic Coliadine, *Nathalis iole* Bdv., which may be of South American origin. The adaptive significance of this character in those species which do not resemble thorns or twigs requires investigation.

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